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MONTHLY REPORT - JULY 1978

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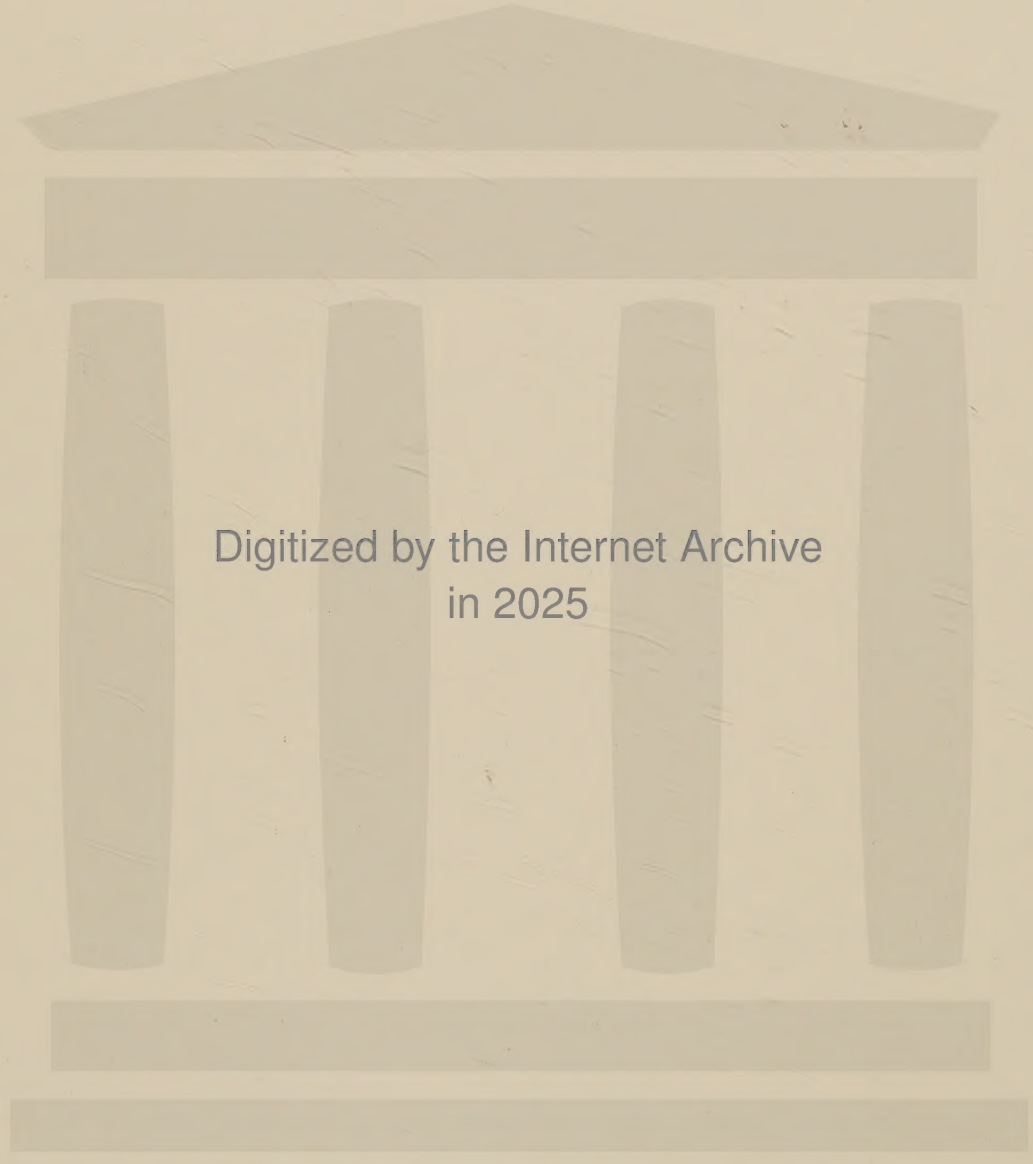

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SOUTHWEST FISHERIES CENTER
La Jolla, California

Honolulu Laboratory
La Jolla Laboratory
Tiburon Laboratory
Pacific Environmental Group

MONTHLY REPORT - JULY 1978

STATUS OF PUBLICATIONS

Published

Chess, J.R. 1978. An airlift sampling device for in situ collecting of biota from rocky substrata. Mar. Tech. Soc. Journ. 12(3):20-23.

Quantitative sampling of benthic organisms can be achieved by "vacuuming" the substrata with an airlift suction device. The apparatus consists of a 3m long, 55 mm I.D. PVC tube, and air supply, and a nitex collecting bag. Air is introduced through a manifold into the tube's lower end, the sample material is drawn upward by the rising bubbles and is collected in the mesh bag attached to the upper end. The airlift sampler was used extensively during three years of studying predator-prey interactions at Catalina Island.

Hurley, Ann C. 1978. School structure of the squid Loligo opalescens. Fishery Bulletin, U.S. 76(2):433-442.

The squid Loligo opalescens forms schools which are similar in many respects to those of obligate schooling fishes. These schools are marked by parallel orientation of individuals and strong cohesiveness. Laboratory experiments indicate that the main sensory modality regulating schooling is vision. Squid on opposite sides of a clear rigid Plexiglas barrier readily schooled. The structure of schools of six squid depended on size of individuals and was modified by environmental disturbance. Parallel orientation was weaker in schools of smaller squid (ca. 7 cm dorsal mantle length) than it was in larger ones (ca. 12 cm). In the field, L. opalescens schools are composed of uniformly sized individuals. Laboratory experiments designed to determine whether this was due to actual size

This report does not constitute publication and is for information only.

selection were inconclusive, but they did suggest mechanisms which might be important in determining squid position in the school.

Moffatt, Nancy M. and Donald A. Thomson. 1978. Reciprocal hybridization between the California and Gulf of California grunions, Leuresthes tenius and Leuresthes sardina (Atherinidae). Fishery Bulletin, U.S. 76(2):476-480.

The California grunion, Leuresthes tenuis, and the Gulf of California grunion, L. sardina, are the only fishes that temporarily leave the water during spring high tides to deposit their eggs in beach sand. Recent comparisons show that morphological, physiological, and behavioral differences exist between the grunions. Morphologically very similar, the most diagnostic characteristics distinguishing them are lateral scale row counts; the mean number in L. tenuis is 75 and in L. sardina is 55. In an attempt to further illuminate the relationship between the grunions, the authors made artificial and reciprocal crosses and report in this article on the first successful reciprocal hybridization of L. tenuis and L. sardina. Although they were successful at hybridizing L. tenuis and L. sardina, the authors believe that the morphological, physiological, and behavioral distinctions between them warrant their continued recognition as separate species.

Moser, H.G. and E.H. Ahlstrom. 1978. Larvae and pelagic juveniles of blackgill rockfish, Sebastes melanostomus, taken in midwater trawls off southern California and Baja California. Journal of the Fisheries Research Board of Canada 35(7):981-996.

Examination of 217 midwater trawl samples from the coastal basins off southern California and Baja California revealed a recurring group of rockfish species. The late larvae and pelagic juveniles of the blackgill rockfish, Sebastes melanostomus, constituted 16% of the total number of rockfish specimens. The life-history stages of this species are described, with emphasis on the pelagic juvenile stage. Late stage larvae and pelagic juveniles develop a distinctive pattern of melanophore bands which, by disrupting the body outline, may help conceal the young during their midwater existence. Evidence from midwater trawl collections suggest that 30 mm pelagic juveniles migrate or are carried shoreward at a depth of 200 m to the appropriate habitat for settling. The high relative abundance of blackgill rockfish pelagic juveniles in midwater trawl samples suggest that this species may represent a potential resource.

Squire, James L., Jr. 1978. Northern anchovy school shapes as related to problems in school size estimations. Fishery Bulletin, U.S. 76(2):443-448.

Horizontal fish school profiles of the northern anchovy, Engraulis mordax, taken from day aerial photographs and video tapes of school bioluminescence of night were examined to determine the percentage of school area within a circular field of view and the school length and width ratios. Schools observed during the day had an average length to width ratio of 2.09:1, at night the ratio was 2.53:1. The percent coverage of the school's area in relation to a circle drawn tangent about the school averaged 42.1% during the day and 29.2% during the night. The effect of school shape on estimation of individual school area as observed with a side-looking sonar was determined. School width measurements, similar to that obtained by the sonar, were used to determine school area and indicated a possible average overestimate of the actual school area of 1.72:1. The relation of school length and width to the error was determined, indicating the greater length to width ratio the greater the error.

Theilacker, Gail H. 1978. Effect of starvation on the histological and morphological characteristics of jack mackerel, Trachurus symmetricus, larvae. Fishery Bulletin, U.S. 76(2):403-414.

Histological and morphological criteria were developed to assess the nutritional condition of laboratory-reared jack mackerel, Trachurus symmetricus, larvae. A comparison of the histological features of fed and starved larvae revealed that the digestive tract and its associated glands were the first tissues to be affected by starvation. The extent of cellular deterioration increased with time of starvation. To classify larval condition, histological characteristics of the pancreas and gut were given numerical grades. The histological technique correctly classified 83% of the feeding and starving larvae.

The morphometric analysis relied upon a stepwise discriminant analysis that used a combination of five measurements (standard length, head length, eye diameter, body depth at the pectoral, and body depth at the anus) to estimate individual larval condition. The morphometric method was as sensitive as the histological examination in determining whether or not a larva was fed or starved. Ultimately, these histological and morphological criteria may be useful for estimating larval survival in the field by assessing the condition of sea-caught larvae.

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Pacific Fishery Management Council. 1978. Northern anchovy fishery management plan. Federal Register 43 (141):31655-31783.

(Note: Although the authors of this plan are not identified in the published article, the major contributions of Dan Huppert, G. Stauffer, J. McMillan and K. Parker of the La Jolla Laboratory and A. MacCall of the California Fish and Game to the writing of this plan are known and acknowledged.)

Approved by Center Director

Methot, Richard D. and David Kramer. Growth of anchovy larvae in the sea. For publication in the Fishery Bulletin, U.S.

King, Dennis M. Measuring the economic value of the eastern tropical Pacific tuna fishery. For publication in Proceedings of the Western Association of State Game and Fish Commissioners.

Huppert, Daniel and Jane McMillan. California's wetfish and market fish fisheries - economic values. For publication in Proceedings of the Western Association of State Game and Fish Commissioners.

Whipple, Jeannette A., Thomas G. Yocom, D. Ross Smart and Meryl Cohen. 1978. "Effects of chronic concentrations of petroleum hydrocarbons on gonadal maturation in starry flounder (Platichthys stellatus (Pallas))." Prepared for the Proceedings of the Conference on Assessment of Ecological Impacts of Oil Spills, Keystone, Colorado, June 14-17, 1978. Coordinated by American Institute of Biological Sciences.

HONOLULU LABORATORY

RESOURCE ASSESSMENT AND DEVELOPMENT INVESTIGATIONS (RADI)

Work Continues on Fishery Management Plans

Dr. Jerry Wetherall, Leader, Fishery Management Research Task, reported that members of the Task continued activities related to the preparation of Fishery Management Plans and other aspects of extended fishery jurisdiction. Dr. Michael Adams, Economist, and his staff continued their economic analysis of the billfish fishery in Hawaii. Adams prepared contract specifications for a proposed survey of fish landings, inventories, prices, and other economic statistics in American Samoa and Guam in connection with the billfish FMP.

Wetherall and Ms. Marian Yong, Mathematician, continued summarizing catch and effort statistics of the foreign tuna longline fleet based at American Samoa, in response to a request from the Department of State. Wetherall also analyzed catch and effort statistics for the pelagic armorhead resource on the seamount chain north of Midway Island. The chain, including the Hancock Seamount, which is in the U.S. Fishery Conservation Zone (FCZ), supports a Soviet and Japanese trawl fishery. The Japanese catch on the entire chain is 20,000-30,000 metric tons (MT) per year; the Soviet harvest is unknown. Making a number of assumptions, Dr. Wetherall estimated the maximum sustainable yield to be roughly 50,000 MT per year for the chain. One assumption is that there is a single stock of armorheads exploited throughout the seamount chain, so that only a small fraction of the resource and the armorhead catch is associated with the Hancock Seamount inside the FCZ. Management policy options are being evaluated for inclusion in a draft FMP.

Status of the Cooperative Study of the Northwestern Hawaiian Islands Discussed

Dr. Robert Skillman, Coordinator of the Cooperative Study of the Northwestern Hawaiian Islands (NWHI), reported that the first of an anticipated series of monthly meetings of study participants was held on July 18. The purpose of the monthly meetings is to keep all study participants informed on the status of the various projects, research proposals, new developments, and also, to find solutions to any problems that may develop.

Although the study was originally conceived as a systems study, it has developed in stages as various interested groups became involved. The need to bring all of the individual projects together into a cohesive, systems analysis package was discussed at the meeting. Also, second-year funding from the University of Hawaii Sea Grant will depend in part on whether the separate projects can be unified. As a start in developing the systems analysis package, Laboratory Director Richard Shomura has arranged for Loh Lee Low, Northwest and Alaska Fisheries Center, to present a seminar on a systems analysis study of the living resources of the Bering Sea at the next meeting.

The seminar presentation at the first meeting was made by Craig Harrison, Seabird Biologist, who presented the USFW's project proposal for the NWHI Seabird Program. The presentation was well-received and elicited discussion among the attendees. On the section on Study of Basal Metabolic Rates, it was suggested that measurement of excretion and secretion might provide a measure of the amount of nutrients imported into the insular and island areas. On the subject of telemetry, it was suggested that the NMFS Laboratory at Bay St. Louis, Mississippi might be able to provide technical assistance. The subject of population estimates of seabirds resulted in much discussion, for example, the use to be made of the population estimates, their accuracy, whether absolute or relative estimates were needed, the possibility of measuring

such things as clutch size, egg size, and chick growth to assess the success of the population, and ability to monitor daily immigration and emigration.

Research Cruise to Western Pacific Completed

The NOAA research ship, Townsend Cromwell, returned to Honolulu on July 21 after completing a 10-week survey and assessment cruise to waters around Guam and the Northern Mariana Islands. The cruise was a joint effort of the Honolulu Laboratory, the Guam Division of Fish and Wildlife, the University of Guam Marine Laboratory, and the Northern Marianas Fishing Authority.

Richard N. Uchida, Chief Scientist on the cruise, reported that the highest density of commercially valuable bottom fish such as snappers, groupers, and carangids, occurred along the seamounts and other undersea features such as Arakane Reef, Pathfinder Reef, and several unnamed banks and reefs. Night "jigging" for bigeye scad, Trachurops crumenopthalmus, during the dark moon phases of the month was particularly effective at some of the fishing stations over the seamounts. The survey also revealed that relatively high densities of pandalid shrimps, Heterocarpus ensifer and H. laevigatus, occur in certain areas around Guam and the Northern Marianas. These shrimps were caught in pots set in waters ranging from 365 to 820 m in depth. The highest catch rate of 1975 shrimps per pot occurred in 640-730 m of water near Guguan Island.

Trolling was also very productive over some of the offshore seamounts and produced catches of yellowfin tuna, Thunnus albacares, skipjack tuna, Katsuwonus pelamis, and rainbow runner, Elagatis bipinnulatus. Of 226 fish caught by trolling, 114 were tagged and released.

Fish and lobster trapping operations were generally unproductive. Among commercially valuable fish caught by trapping were Lutjanus bohar, L. kasmira, L. gibbus, Lethrinus variegatus, L. miniatus, Adioryx spinifer, A. tiere, A. andanensis, Epinephelus emoryi, Myripristis berndti, Caranx lugubris, and C. ferdau.

In addition to Uchida, the scientific field party included Research Assistant Paul Shiota, who was Acting Chief Scientist on the Honolulu to Guam portion, and Research Assistant Robert B. Moffitt, who was Acting Chief Scientist on the Guam to Honolulu portion of the cruise.

Tagged Skipjack Tuna Recovered in Hawaiian Waters

A skipjack tuna, bearing an Inter-American Tropical Tuna Commission tag, was recaptured on July 24 by the Hawaiian bait boat, M/V Sea Queen. At the time of recapture, the fish measured 80.5 cm and weighed 13 kg.

According to IATTC records, the fish was tagged and released off Roca Partida on November 17, 1975, and thus was at liberty for about 32 months before it was recaptured.

Meetings Held to Discuss Fish Aggregation Project

Walter Matsumoto, Fishery Biologist, conducted a series of meetings this month to discuss a statewide fish aggregating devices system for Hawaiian waters. The meetings were held at Maalaea, Maui; Lanai City, Lanai; and Lihue and Hanapepe, Kauai. Participating in the meetings were representatives from the Governor's Office, Hawaii Division of Fish and Game, University of Hawaii Sea Grant Program, and the Honolulu Laboratory. The purpose of the meetings was to obtain input from the user group as to the placement of the buoys in the various fishing areas and to determine whether the users would be willing to contribute to defray the cost of installing and maintaining the system.

Relative to the aggregation project, Matsumoto also reported that activity continued at a low level around the aggregating buoys. Only four visits to the buoys were reported by the Hawaiian bait boats. The bait boats generally fished in other areas in search of the large, seasonal skipjack tuna entering the fishery. The rough seas that prevailed during July also limited the activity of the recreational boats. The sports fishermen confined most of their activity to the lee of the island off Waianae and around Barbers' Point. No reports were received on the results of the few visits made to the buoys.

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Dr. Roy Mendelssohn, Operations Research Analyst, continued his work on improving bounds for the solution of aggregating linear programs. To speed the progress of this work, Debra Chow, Computer Programmer, was hired to implement the computational algorithms. Their results have been extremely encouraging. Not only have the solution bounds been narrowed markedly, but the number of iterations required to reach the solutions has been drastically reduced.

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Members of the Insular Resources Task were involved with various tasks. Thomas Hida, Fishery Biologist, assisted by Research Assistants Thomas Kazama, Victor Honda, Glenn Higashi, Bert Kikkawa, and Darryl Tagami, fabricated shrimp and octopus pots. The shrimp pots are of a simple design, which if successful, may cut the cost of maintaining and repairing sampling gear, compared to that of gear presently in use. The design includes the use of a 20-gallon, rectangular, plastic container which is fitted with a cone funnel on one end and is perforated with holes on the other end.

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Work continued on processing otoliths for age and growth studies. Research Assistant Robert Humphreys worked on Lutjanus kasmira otoliths; Bert Kikkawa verified counts on Pristipomoides microlepis otoliths made by another reader, and Jeff Sampaga read otoliths of Seriola dumerilii. James Uchiyama, Fishery Biologist, in a cooperative study with the Inter-American Tropical Tuna Commission, verified counts on otoliths of skipjack tuna which were treated with tetracycline.

Uchiyama who will be Chief Scientist on Townsend Cromwell cruise 78-03, completed the final draft of the cruise instructions and circulated it to all cruise participants. Mr. Tagami, on the Libra, and Mr. Higashi, on the Easy Rider, returned from fishing trips to the NWHI.

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Laurie Sanderson and Alan Solonsky, University of Hawaii Marine Options Program students, worked on identifying fish and crustacean specimens collected from the NWHI, Guam, and the Northern Marianas. Research Assistant Brian Joyo continued work on ciguatoxin analysis at the University of Hawaii.

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Skillman reported that the second quarterly summaries of catch, fishing effort, and catch per unit effort for the South Pacific albacore fishery for calendar year 1977 were completed and sent to government and industry offices. Plots of the historical trend of catch per unit effort for albacore and yellowfin tuna from 1970-77 indicate that the condition of the albacore stock has improved from its low in 1975. The yellowfin tuna shows annual fluctuation, but no apparent long-term trend.

In preparation for a new, updated summary of the status of the longline fishery based in American Samoa, Skillman also has been writing and editing a computer program to summarize various estimates of fishing effort.

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Fletcher Riggs, Fishery Biologist, assisted by Marian Yong, Mathematician, modified an existing computer program which summarizes catch, fishing effort, and catch per unit effort by species for designated geographical areas to provide weighted catch and effort statistics. The modified program was used to summarize data from the longline fishery based at American Samoa.

Estimated Skipjack Tuna Landings Continue Below Long-Term Average

The July 1978 Hawaii landings of skipjack tuna were estimated at 401 MT, which is 11 MT above the landings for the same period in 1977 and 432 MT below the 1948-77 long-term average for the same period.

The cumulative landings from January through July were estimated at 2,044 MT, which is 235 MT below last year's landings for the same period and 618 MT below the 1948-77 long-term average for the same period.

FISH-ENVIRONMENT INVESTIGATIONS (FEI)

Physiological Thermoregulation Experiments Continue

Dr. Andrew Dizon, Leader, Experimental Ecology of Tunas Task, reported that during the month of July, work continued on an experiment designed to demonstrate physiological thermoregulation in skipjack tuna. Fish were equipped with temperature-sensitive ultrasonic transmitters and observed in a temperature-controlled environment. Increases in activity levels of the fish were induced by force-feeding them with lead slugs, i.e., the fish must maintain higher swimming speeds to counteract its artificially increased density or sink to the bottom of the tank. The experiment then called for an increase in environmental temperatures. In response to higher ambient water temperatures, the fish could not reduce heat production by slowing down (since it would sink) so this form of behavioral thermoregulation was unavailable. It was expected that the fish would have to employ physiological means to increase heat dissipation to prevent developing excessively high body temperatures and indeed this was observed in the three fish that lasted long enough to experience the higher temperatures. Most of the fish died before or during the temperature change from 25° to 30° C, the latter being the test temperature. Experiments were conducted on 10 fish during the month of July; all were unsuccessful.

Presently an effort is being made to determine the possible cause of the mortality. The thermoregulation experiment has several stressful aspects and each one will be examined as a possible cause of mortality. Transfer into the experimental tank system, residence time in the tank system, force-feeding of lead slugs, and the attachment of the transmitter will be examined as separate treatments. Of course, cumulative effects of all these treatments may make the thermoregulation experimental design impractical.

Progress Reported in Burnt Tuna Project

Dr. Jean Cramer, contractor on the Burnt Tuna Project, reported progress to date on various aspects of the project. Data on small yellowfin tuna, including catching interval, body temperatures, and hour caught were obtained on a sportfishing boat based at Pokai Bay, Oahu. Tissue samples were also collected from the fish. Data were also collected on pH readings of tuna tissue. This was done to test the pH probe and also to obtain pH data on burnt and unburnt tuna flesh. Readings of the probe, when inserted into intact tuna were similar to

that obtained by inserting it into ground-up tissue suspended in distilled water. However, the pH values of the burnt and normal tuna flesh were not consistently different, which is contradictory to the data collected last fall.

Cramer also made cooperative study arrangements with other investigators who are investigating various problems which may be related to burnt tuna. Cooperative data-collecting arrangements were made with Dr. Ed Noda, University of Hawaii Ocean Engineering Department, who is doing preliminary research on refrigeration and rapid-killing techniques of tuna. Dr. Peter Hochachka, University of British Columbia, has agreed to run biochemical tests (pH, CPK, lactate, glucose, and free amino acids) on blood and tissue. Dr. Hilmer Frank, University of Hawaii, ran histamine tests on the flesh of the small yellowfin tuna collected earlier. All samples were low on histamine.

Attempts to Track Yellowfin Tuna Continued

Heeny Yuen, Leader, Recreational Fisheries Task, reported that another attempt was made to track yellowfin tuna following the abortive attempt last month. The purpose of the experiment was to collect data on migration pathways, depth, and temperature distribution of free-swimming fish and diel activity patterns of yellowfin tuna.

Four days, July 3 to 6, were spent at sea in the attempt to track yellowfin tuna. The project was a joint undertaking with the Hawaiian Invitational Allison Tuna Tournament which chartered a boat, Kamalii Kai Too, for the tracking. Two large yellowfin tuna, each estimated at over 100 kg, which were provided without cost by local fishermen who were fishing during that period, were tagged with transmitters and released. Because of difficulties with the tracking equipment, one fish was tracked for only 10 minutes and the other, not at all. In addition to Yuen, Dizon and Research Assistant James Cooper, also participated in the cruise.

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Dizon reported that experimental work continued on active respiration of fish; one more kawakawa, Euthynnus affinis, was tested. The respiration rate of the 46.5 cm, 2,040.8 g kawakawa swimming at a mean speed of 1.57 body length sec^{-1} was 0.6340 mg $O_2 g^{-1} hr^{-1}$.

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A manuscript, "Physiological thermoregulation in tunas," authored by Dizon and Richard Brill, University of Hawaii graduate student, is being prepared for presentation at the American Society of Zoologists meeting which will be held in Richmond, Virginia from December 27-30, 1978.

LA JOLLA LABORATORY

Coastal Fisheries Resources Division

ALBACORE FISHERIES PROGRAM

La Jolla Laboratory Selected to Participate in Evaluation of Utility of Satellite Ocean Data Products

Dr. M. Laurs, Leader of the Albacore Fisheries Program, reported that the La Jolla Laboratory has been selected to participate in a NASA-sponsored program to evaluate the utility of SEASAT-A satellite ocean data products to various ocean-related users. SEASAT-A, which was launched in late June 1978, is the first satellite dedicated to ocean science and applications. It will circle the earth approximately 14 times daily and its sensors will cover 95% of the global ocean area every 36 hours. Sensors aboard the spacecraft will send back information on surface temperature and winds, currents, wave heights, ice conditions, ocean topography, and coastal storm activity.

Laurs was approached by officials from the Jet Propulsion Laboratory (JPL), acting on behalf of NASA, to develop a fishery demonstration experiment to evaluate the utility of SEASAT-A data products to the U.S. tuna fishing fleets. After a series of meetings between Drs. Laurs and Sakagawa, Leader of the Tuna Resources Program with the Oceanic Division, and JPL officials, a proposal for the design of the experiment was completed, and a Memorandum of Agreement between the SWFC and NASA to conduct the experiment was signed in early July by Director Barrett. The experiment is divided into a U.S. albacore fishery portion, which was prepared by Laurs and a U.S. eastern tropical Pacific portion, prepared by Laurs, and a U.S. eastern tropical Pacific portion, prepared by Sakagawa.

The experiment plan is based on the fishery advisory capabilities at the La Jolla Laboratory and incorporates elements of a proposal submitted to JPL by IATTC satellite-oceanography scientists before the group was disbanded.

Experiment Objectives--Objectives of the Eastern Pacific Tuna Fishery SEASAT-A experiment are to (1) evaluate the reliability of existing fishery advisory FAX products against those from SEASAT-A in assisting U.S. tropical tuna fishermen in making tactical fishing decisions; (2) evaluate the utility of SEASAT-A products in assisting U.S. albacore fishermen in making tactical fishing decisions; (3) evaluate the potential of SEASAT-A products in providing useful information in managing the tropical tuna and albacore tuna fisheries; and (4) evaluate the usefulness of SEASAT-A products to ongoing research in fishery-oceanography in the eastern Pacific.

Experiment Design & Approach--The experiment is designed to (1) draw upon the experience and expertise that the SWFC has accumulated in operating fishery advisory programs involving the U.S. tuna industry, (2) effectively utilize the communication network that SWFC has in place through radio station WWD for its ongoing fishery advisory/FAX programs, and (3) draw upon the fishery specific data bases and historical records that SWFC has accumulated.

On request, Fleet Numerical Weather Central (FNWC), the ground station where SEASAT-A data are received and processed, will transmit to SWFC, via data line, a set of predetermined SEASAT-A/FNWC fishery data products. The products will be received on a Tektronix terminal and hard copier. At SWFC, the products will be evaluated, annotated and reformatted as necessary. Copies of the received and annotated data will be made by SWFC for later analysis and evaluation. The forecast products will then be delivered to radio station WWD, which will broadcast them on a daily basis, for reception by tuna vessels possessing radio facsimile records.

In return, participating tuna fishing fleet vessels will transmit, to radio station WWD, wind, weather and sea-state messages. This also will be done on a daily basis. From WWD the information will be relayed via teletype to the SWFC where it is stored on a magnetic tape for daily transmission to FNWC.

In the initial stages of the experiment, November to December 1978, the fishery data products will be evaluated by SWFC for composition, accuracy, precision and clarity. Operational procedures will be developed during this period. Beginning about February 1979, the experiment is expected to be fully operational with SEASAT-A products being transmitted via FAX to the tropical tuna fishery. Operational procedures for products to be transmitted to the albacore fishery will be developed after February 1979 and will become operational in June 1979. The experiment is designed to extend over two fishing seasons for both the tropical and albacore tuna fisheries.

Experiment Evaluation--A comprehensive investigation will be conducted during and after the experiment to assess the results with respect to the objectives of the experiment. The evaluation will consist of: (1) contacting participating vessel owners after each fishing trip, when possible, for information on their use of FAX products; (2) contacting participants at the end of the fishing season for their overall assessment; (3) evaluating records maintained by selected fishermen, and (4) product contents will be analyzed for information to predict fishing success in areas of vessel concentration. Of particular interest in this evaluation are the operational or planning decisions that are or could be impacted by the use of SEASAT data in reducing the uncertainty of the decisions and the estimated economic or operational value of the data.

Cooperative Blood Studies on Albacore Tuna Continue

Hematological studies on albacore tuna were conducted during the September 1977 albacore physiology cruise. Medical scientists at Scripps Clinic and Research Foundation and UCSD School of Medicine are carrying on these studies in cooperation with Dr. M. Laurs of the Albacore Fisheries Program at La Jolla. Hemograms were recently completed on blood samples from 18 albacore and 15 skipjack tuna, which were also collected on the cruise. Erythrocytic parameters included red cell counts, reticulocytes, packed cell volume, hemoglobin and red cell indices. Leukocyte parameters included white cell counts and differentials and platelets were tabulated per 100 white cells. In addition, measurements were made on all cell types with an ocular micrometer and photomicrographs were made of the various cell types. The results are summarized in the following table. Additional hematological studies are planned during the albacore cruise scheduled in September 1978.

Summary of hematologic parameters for albacore and skipjack tunas.

	ALABACORE (n=18)			SKIPJACK (n=15)		
	range	mean	std	range	mean	std
Length mm	549 - 769	660	74	515 - 565	553	22
Weight gms	3312 - 8195	5703	1770	2535 - 4542	3515	519
PCV %	42 - 57	50.2	4.3	42 - 66	59.3	6.0
HGB g/dl	11 - 17.8	15	1.5	15.8 - 22	18	2.4
RBC x 10^6	2.65 - 4.3	3.1	.47	2.5 - 4.8	4.14	.60
MCV microns	108 - 203	161	21	108 - 170	143	18
MCH picograms	36.8 - 60.6	45	12.8			
MCHC %	26.2 - 33.5	30.2	2.8	27 - 33.5	30.4	2.5
Reticulocytes %	3.4 - 9	6.4	1.7	2.4 - 9.9	5.1	2.6
Platelets / 100 WBC's	86 - 544	282	125	100 - 740	251	140
Neutrophils	0 - 80	30	25	10 - 98	38	21
Lymphocytes	0 - 92	64	20	2 - 92	52	21
Eosinophils	0 - 28	17	11	0 - 24	13	7
Eosinophil-like	0 - 12	7	4			
Monocytes	0 - 20	8	6	0 - 12	6.8	3

CELL DIMENSIONS (microns)	length	width	length	width
ERYTHROCYTES	9.0	6.6	8.0	6.4
PLATELETS	4.7	3.0	6.7	4.0
NEUTROPHILS	8.6	7.9	8.1	5.5
LYMPHOCYTES	5.7	5.2	6.3	5.5
EOSINOPHILS	8.9	5.0	5.3	4.8
EOSINOPHIL - LIKE	6.6	5.0	5.3	4.8
MONOCYTES	10.5	9.5	9.8	9.4

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A manuscript has been drafted entitled "Assessment of Environmental Conditions in the Eastern North Pacific Ocean - January 1977 to March 1978" co-authored by D. McLain (PEG), F. Favorite (NWAFC) and R. Lynn (SWFC) with the aid and contribution of other NMFS personnel. The objective of this paper, to be submitted to Marine Fisheries Review, is to provide an overview of ocean climatic variations that affect or potentially affect fishery resources. Lynn used the long data series of sea level pressure, sea surface temperature, and anomaly of sea surface temperature available through the preparation of the Fishing Information publication and the Ekman transport data provided by A. Bakun of PEG in the study of large-scale events. Also the recent CalCOFI cruise data and historical CalCOFI averages were used in the study of the California Current region. Laurs edited a draft of the manuscript.

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In an extension of the environmental assessment study, Lynn has examined the occurrence of extreme low salinities in the California Current. Professor C. Cox of Scripps Institution of Oceanography made a rough estimate of the possible rainfall over the ocean based on the assumption that the anomalies in salinity were caused thusly and encouraged Lynn in this study.

MULTISPECIES TAXONOMY PROGRAM

Group Successful in Rearing Four Species of Croakers in Laboratory to Obtain Developmental Series

Croakers of the family Sciaenidae constitute an important fisheries resource in the nearshore waters of southern California and Baja California. Their eggs and larvae occur commonly in the coastal samples of the CalCOFI plankton surveys. Identification of croaker eggs and larvae is difficult because the larvae settle to the bottom soon after hatching. Thus, larvae with fully formed fins needed to identiy the developmental series are absent from plankton tows.

Under the direction of Dr. H. G. Moser, Program Leader, and with the assistance of Fishery Biologist John Butler, a major goal of the multispecies taxonomy rearing project has been to provide complete developmental series of the seven local croaker species so that the earlier stages found in the CalCOFI samples can be identified. Moser and Butler began rearing croakers from eggs taken in plankton hauls in April and in 4 months have established complete developmental series of four series (see table).

Species	Start	End	Days	Max. Size
Seriphus politis (Queenfish)	4/4	still going	122	60 mm
Cheilotrema saturnum (Black croaker)	5/18	"	77	32 mm
Roncador stearnsi (Spotfin croaker)	5/18	7/25	67	36 mm
Menticirrhus undulatus (California corbina)	6/15	7/21	36	14 mm

In addition to the major series of Seriphus, a second series was reared (5/12 - 7/5), preserved in alcohol and analyzed for daily growth increments. A partial series of the yellowfin croaker (Umbrina roncador) and an extremely interesting croaker-like larva which cannot be identified to family has been obtained. Its fin counts come closest to the white croaker, Genyonemus lineatus, whose larvae has not been reared but which can be identified from other collections. The unidentified series is perplexing because it has three anal spines whereas croakers normally have only two anal spines. Its meristics do not match any shore fish from California or Baja California and it presents an interesting side benefit to the rearing work.

The white croaker begins to spawn in the fall and will be reared when its eggs become available. That leaves only the white sea bass, Cynoscion nobilis, and the early stages of the yellowfin croaker which remain to be reared. There is some doubt whether the former spawns regularly in southern California waters.

In addition to the croakers, Moser and Butler have reared many other series of shore fishes including kelp bass, Paralabrax clathratus; cuskell, Otophidium scrippsi; mussel blenny, Hypsoblennius jenkinsi; California halibut, Paralichthys californicus; several turbots, Pluronichthys and Hypsopsetta; sheephead, Pimelometopon pulchrum; and the slough anchovy, Anchoa delicatissima.

Center Scientists Present Lecture Series at Ensenada University

Drs. Geoffrey Moser, Leader of the Multiple Species Taxonomy program and Elbert Ahlstrom, Senior Scientist at the La Jolla Laboratory, cooperated in presenting a plankton course at the Centro de Investigacion Cientifica y Educacion Superior de Ensenada (CICESE), July 17 to 21. Ahlstrom and Moser alternated days in giving the lectures. The lectures

were in English, but liberal use was made of the blackboard to stress many points and also to present some of the background information in tables which could be copied by the students. During the course 48 life history series were studied (12 per day for the first four days of the course). On the first day students were given CalCOFI samples to try to identify the constituents (this was to test how well they could utilize their observations on the life history series with which they were presented and also to use the reference material provided each student).

The 48 life history series dealt with larvae which could be collected in Santo Tomas Bay at Ensenada or immediately offshore of this area. (Line 100 in the CalCOFI pattern has its inner station off Ensenada.) The series included larvae for all species of concern and with eggs as well for most species. The most abundant 12 kinds of larvae in CalCOFI collections contribute about 90% of the larvae obtained on CalCOFI cruises. All of these were included among the life history series studied at Ensenada. There were about 20 students who attended regularly plus several additional part-time students. The handouts, prepared by Moser and Ahlstrom, included meristic counts for all species studied, and a list of selected references. Dr. Ahlstrom reported that a number of the students enjoyed trying to identify larvae from CalCOFI stations on the final day of the class.

Analysis of Growth Rates of Larval, Anchovy in California Current Nearing Completion

Richard Methot, University of California graduate student, reports that analysis of the growth rates of larval anchovy in the California Current during January 1978 is nearing completion. Anchovy larvae were found in 17 of the 43 alcohol preserved samples which were sorted. The otoliths of 606 larvae were mounted and the daily growth increments counted by at least one person. Verification of these counts has been completed for 300 larvae from 9 samples.

The variance in growth rate among these 9 samples was small, although a rigorous statistical analysis has not yet been conducted. When the data of the 6 samples from the Southern California Bight are combined, the result is very similar to that observed in this region in March of 1976 and 1977 (Methot and Kramer, "Growth of anchovy larvae in the sea," submitted to the Fishery Bulletin). Growth in the 3 samples from southern Baja California was only slightly faster but not nearly as fast as larvae grown in the laboratory at 17 to 20° C.

Area	Time	Temperature range	No. of samples	Mean size at age 10 days	Mean size at age 20 days
So. Calif. Bight	March 1976	15.0-15.8°C	3	5.4 mm	9.3 mm
"	March 1977	13.0-15.2°C	6	5.7 mm	9.4 mm
"	Jan. 1978	14.9-17.0°C	6	5.4 mm	9.0 mm
Southern Baja Calif.	Jan. 1978	17.6-20.2	3	6.2 mm	10.5 mm

No correlation existed between temperature and growth rate of larvae in the sea. Growth was as fast in a 13° sample from March 1977 as in a 20° sample from January 1978. There are two plausible, but not mutually exclusive, explanations for this result. A strong inverse correlation could exist between temperature and larval food so that larvae living in warm water are food limited while those in cold water are not. A second explanation is that when the mixed layer is too warm the larvae descend into the thermocline where they may take advantage of their own reduced metabolic rate and perhaps encounter good feeding conditions in a chlorophyll maximum layer.

COMMERCIAL AND RECREATIONAL FISHERIES RESEARCH FOR MANAGEMENT

Anchovy Plan to be Implemented September 15

Dr. D. Huppert, Leader of the Commercial & Recreational Fisheries Research for Management program, reported that the Anchovy Advisory Panel and the Pacific Management Council were given the report annoucing the 1978 biomass of northern anchovies. The estimated biomass of 1,304,000 short tons resulted in an annual U.S. reduction quota of 58,333 short tons which is much lower than the industry desired. The estimate and quota were, however, received very well according to Huppert.

Assistant Administrator for Fisheries, Terry Leitzell, and Administrator of NOAA, Richard Frank, have signed and accepted the plan. After a public review period for the Proposed Regulation, the Plan will be implemented by September 15 when the major southern California reduction fishery begins.

Jack Mackerel Plan

The Jack Mackerel Plan Development team met at the La Jolla Laboratory July 26. Attendees included Chairman Alec MacCall, Herb Frey and Eric Knaggs representing CF&G and Gary Stauffer and Jane McMillan (substituting for Dan Huppert) representing NMFS. The team agreed to a working outline for the plan, made specific assignments to team members, and set up a schedule for finishing drafts of the plan. Although the plan is not scheduled to be implemented until 1980, the team will attempt to have a complete first draft available by the end of 1978. A meeting between the team and the jack mackerel advisory panel is scheduled for September 12, 1978.

Economic Paper Completed on Value of California's Wetfish and Market Fish Fisheries

Economists Dan Huppert and Jane McMillan completed a paper on the above topic during July. The paper, along with several others on economic valuation of West Coast marine fisheries, was presented during

the July 18-20 meeting of the Western Association of Fish and Wildlife Agencies in San Diego. The methods and data problems involved in estimating the wholesale value of fishery products in California were covered in some detail. The final estimates are as follows:

Summary of estimated wetfish and market fish economic values.

	1975	1976
	($1000's)	
Wetfish		
Ex-vessel	10,485	9,354
Processed	24,082	16,931
Market fish		
Ex-vessel	18,626	23,736
Wholesale	35,581	47,763
Total values		
Ex-vessel	29,111	33,090
Processed/wholesale	59,663	64,694

Alternative Anchovy Biomass Estimate Methods Developed

Keith Parker, Statistician, has begun investigating the use of aerial survey data. This involves two activities: (1) research into the statistical design of unbalanced analysis of variance and covariance, and (2) implementing the BMD general linear hypothesis program, BMDIOV.

Work is continuing on the methods for estimating biomass from age composition. Parker has now completed a critical part of the project, namely standardizing age compositions from midwater trawls per 20-minute square. A report will be completed on this during August.

LARVAL FISHES, COASTAL EAST PACIFIC PROGRAM

Fecundity of the Northern Anchovy and Gonad Weight-Body Weight Relations Investigated

Fecundity of northern anchovy has been estimated by J. MacGregor, Fishery Biologist at the La Jolla Laboratory, (1968) and by Norberg (California Dept. Fish and Game, unpublished). The supposition underlying both estimates was that the number of eggs in the most advanced mode represents the number of eggs in a spawning batch. Owing to the importance of batch fecundity in estimates of spawning biomass from egg

and larval production, J. Hunter, R. Leong, Fishery Biologists and T. Mickel, Biological Aid, decided to determine batch fecundity using the females classified into reproductive classes by histological techniques.

Histological examination of females with recent post-ovulatory follicles indicated that very few hydrated eggs are retained after spawning. Thus, the number of hydrated eggs within ovaries prior to ovulation (females with no post-ovulatory follicles) should give the most accurate estimate of the number of eggs spawned. Another advantage of using hydrated eggs was that they stand out as an isolated class of eggs, distinct from all others; they differ in appearance and are much larger. Hence, they only need to be counted rather than relying on statistical techniques or one's judgement to separate overlapping modes.

The mean number of hydrated eggs per gram of female (ovary free) was 389 $\pm$ 59 eggs and was only 7% less than that estimated for females with the most mature ovaries (females without post-ovulatory follicles or hydrated eggs). Thus nearly all the eggs in the most advanced mode were hydrated and destined to be spawned. This estimate of fecundity is about 1/3 less than past estimates. Fecundity estimates for other reproductive classes (females with post-ovulatory follicles) were much closer to past ones. Many of the females in these classes had only one mode of yolked eggs whereas about 90% of these classified as non-spawners had two modes. Fecundity estimates for less mature females tend to influence the estimate because the eggs destined to form a second mode have not grown sufficiently to be separated from the rest of the yolked oocytes. Spawning occurs only after two distinct modes have formed.

The relation between gonad weight and female weight was examined within classes of mean egg diameter (in the most advanced mode). The slope of the relation between female weight and gonad weight increased with an increase in diameter of eggs in the most advanced mode and was proportional to about the cube root of the egg diameter; the intercepts were about the same regardless of the mean egg diameter. A general equation was fitted to the data obtaining at r^2 of 0.9. Solving for diameter, the investigators obtained:

$$D = \frac{\text{Log } O + 1.70855}{(1.5456)(\text{Log } W)}$$

where D = mean egg diameter;

O = ovary weight

W = female weight (ovary free)

Using the above equation, 55% of estimates of diameter of eggs in the most advanced mode were within $\pm$ 0.05 mm of the observed values and 95% were within $\pm$ 0.15 mm. Thus the equation appears quite useful for estimation of the maturity stages of the ovary from a gonad weight-body weight relation. It is substantially better than gonad index (ovary weight/female weight) because it avoids a weight bias and also produces

a number that can be directly related to reproductive maturity. The weight bias in gonad index is considerable; for example, a 30 g female with eggs of 0.65 mm diameter in the most advanced mode has a gonad index of 0.62, whereas a 10 g female at the same stage of ovarian maturity has an index of only 0.40. The equation also clearly identifies females with hydrated eggs from weight relationships.

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Dr. R. Owen, Oceanographer, completed the final draft of his paper, "Midwater microlayering of biological particles in ocean waters," to be submitted to Science. The paper summarizes work which demonstrates the high incidence of sub-meter scale patchiness of microplankton. This patchiness explains two paradoxes: first, that there is insufficient food on the average to sustain growth of anchovy larvae, and second, that there are many more kinds of plankton than can be expected from dynamics of populations competing for common resources (Hutchinson's "paradox of the plankton").

Owen began work on sensitivity of the microstructure phenomenon to environmental factors in July. Examination of CalCOFI records, with the help of Larry Eber, Rob Ando and Nick Brinton, yielded the result that stability (density gradient), to which permanence of microstructure should be directly related, can be estimated quite accurately off southern California from the vertical temperature gradient alone. The work required to mix water vertically and thus to destroy microstructure is estimable from temperature profiles, which are easily obtained and analyzed.

Oceanic Fisheries Resources Division

TUNA RESOURCES PROGRAM

Tuna Fisheries Economist Considers Theoretical and Practical Aspects of Eastern Tropical Pacific Tuna Fishery

Dr. Dennis M. King, fishery economist in the Tuna Resources program at La Jolla, presented a paper on "Measuring the Economic Value of the Eastern Tropical Pacific Tuna Fishery" at the annual meeting of the Western Division of the American Fisheries Society (AFS), held July 17-21 in San Diego; and a paper on "The Economic Theory of the Fishery Applied to the Eastern Tropical Pacific Tuna Fishery", at a symposium on Tropical Tuna Fisheries held at San Diego State University, July 21 and 22.

King's presentation to the AFS discussed how the modern structure of the U.S. tuna industry affects the economic analysis of tuna fisheries. Multinational corporations involved in the U.S. tuna industry operate integrated production and distribution networks and published market

data are not always a reliable source of information for evaluating the economic performance of the industry. Employment and earnings figures associated with Pacific West Coast tuna operations were presented, and some 'nonmarket' forces affecting domestic and international prices for raw/frozen tuna were discussed.

His paper presented at the Symposium described some theoretical concepts related to "common property resources" and used them to explain the current economic condition of the eastern tropical Pacific tuna fishery and the economic inefficiencies of the IATTC regime, economic theory would suggest that the fishery would eventually become so "over-capitalized" that the average fishing vessel would be operating only slightly above the break-even point. Although existing data indicates that this is already the case, market imperfections were shown to mitigate some of the economic inefficiences that would be expected on strictly theoretical grounds.

Scientists Attends ICCAT/SCRS Officers' Meeting

The Officers of the Standing Committee on Research and Statistics (SCRS) of the International Commission for the Conservations of Atlantic Tunas (ICCAT) held a meeting in Madrid, Spain from July 17 to 21, 1978. Dr. G. Sakagawa, Leader of the Tuna Resources Program at La Jolla who is the Convenor of the Subcommittee on Skipjack of the SCRS participated in that meeting. Sakagawa reports that the meeting was organized to develop a detailed plan for ICCAT's International Skipjack Year Program, to review progress of the Working Group on Bigeye Tuna Size Regulation and to finalize plans for the upcoming SCRS meeting in Madrid in November. Scientists attending the meeting were A. Fonteneau, SCRS Chairman (France); S. Kume, Convenor of the Subcommittee on Statistics (Japan); O. Rodriguez-Martin, Executive Secretary of ICCAT; P. Miyake, Assistant Executive Secretary, ICCAT; M. Laurent, Biostatistician, ICCAT; J.A. Negreiros, scientist (Brazil); and A. Santos, scientist (Spain). One officer, M.A. Mensah, Convenor of the Working Group on Bigeye Size Regulation (Ghana) was absent.

There appears to be considerable support among the ICCAT member countries for the International Skipjack Year Program, which would begin in 1979 and end in 1982. There is optimism among the international scientists that the program will be adopted in November by the Commission. However, pledges, thus far, of matching contributions, e.g. vessels, materials, scientists, etc. from the member countries that will be necessary to execute the program appears to be far short of requirements for an effective program.

In essence the program has been proposed by the SCRS because of growing world demand for tuna, and the fact that little increase in catch can be expected from the larger species of tuna from any ocean. There is an obvious opportunity for expanding production from Atlantic skipjack

tuna although little is known about these stocks. However, apart from a general feeling among scientists that the Atlantic skipjack tuna stocks are not yet fully exploited, there is at present insufficient information to plan this expansion in a rational manner, avoiding on the one hand any failure to take advantage of opportunities where they exist and on the other, damaging the stock and the fisheries on them through overdevelopment and overexploitation.

The program is designed as an ICCAT-coordinated activity specifically to obtain information on the skipjack tuna stocks through an intensive research effort. Details of the program and resources required for effective execution are being assembled, based on discussion at the meeting, into a document that will be available soon.

The review of progress made by the Working Group on bigeye tuna size regulation showed that collection of data is proceeding smoothly, but a comprehensive analysis of the data and problem will not be available in time for the November meeting.

Plans for the upcoming SCRS meeting were finalized. Plans include appointment of rapporteurs for preliminary preparation of the SCRS report before the meeting, preparation and distribution of an annotated agenda, and proposing that the SCRS examine a long-range planning of activities.

Sakagawa concludes that the meeting, the first of its kind for ICCAT, was most successful and might be required each year in order for the SCRS to respond effectively to increasingly complex issues and assignments of the Commission.

Foreign Imports of Atlantic Tunas
Sampled in Puerto Rico

Biological data consisting of fork length, weight and species composition of imported tunas have been routinely collected in Puerto Rico by Biological Technician Eugene Holzapfel of the La Jolla facility since March 1975.

The samples collected from January through June 1978 by species and gear are as follows:

Species	Gear	No. of Samples	No. of Fish Sampled	Tonnage Sampled (MT)
Yellowfin	Baitboat	16	881	841
	Purse Seine	3	147	84
	Unknown			
Skipjack	Baitboat	9	550	3118
	Purse Seine	1	50	529
	Unknown			
Bigeye	Baitboat	11	561	277
	Purse Seine	2	61	28
	Unknown			
Albacore	Longline	2	100	662
TOTAL		44	2350	5539

Fishery Biologist James Renner of the La Jolla Laboratory, who monitors this sampling reports that the amount of samples collected to date is behind that of last year for the same period. However, Renner expects this situation to improve during the second half of 1978.

Tuna Vessels Continue Participation in FAX Advisory Program

During July 1978, 22 tuna purse seiners contributed synoptic weather and XBT (expendable bathythermograph) data to the NMFS FAX Advisory Program. A total of 173 weather observations and 46 XBT observations were reported. These totals are up 27% and 229% respectively from observations reported during the previous month. Reports are also up from those for July of last year as indicated in the table below:

	July			
	1975	1976	1977	1978
Number of vessels with FAX equipment	75	74	60	50
Number of vessels reporting	33	23	19	22
Number of weather observations reported	342	176	150	173
Number of XBT observations reported	44	24	17	46
Monthly observation total	386	200	167	219

Leading program participants this month were Captain John Gomes of the Santa Rosa (44 weather and 10 XBT observations), Captain John Silveira of the Cheryl Marie (16 weather and 19 XBT observations) and the dedicated tuna vessel, Queen Mary) (14 weather and 15 XBT observations). The FAX staff wishes to expend their appreciation to these boats and to all other contributing participants.

Length Frequency Sampling of Catches from U.S. Seiners Continues Under Contract

Sampling of U.S. Atlantic catches of tunas for length-frequency continued during July. Samples were taken in Mayaguez, Puerto Rico by representatives of the Inter-American Tropical Tuna Commission under a NMFS contract. Yellowfin tuna vessels have been sampled five times for a total of 196 fish from January through July 31 of this year. Fifty skipjack and 48 bigeye have been sampled for the same time period. No other species have been sampled.

Preliminary examination of the data indicates that larger bigeye and yellowfin tunas are being caught this year than in 1977 in the eastern Atlantic. The reason may be attributed to increased fishing farther offshore this year. The sizes of bigeye and yellowfin tunas caught in the nearshore Gulf of Guinea are generally less than 100 cm. Farther offshore, samples indicate that the catch consists primarily of large, 120 to 160 cm. fish. The sizes of skipjack tuna appear to be the same as those recorded last year from the eastern Atlantic. Their catch consists primarily of 41 to 51 cm. fish.

Sampling in Puerto Rico will continue and is expected to increase in intensity as more U.S. tuna seiners were reportedly fishing in the Atlantic. They are expected to begin returning to Puerto Rico near the end of July to unload their catches.

MARINE MAMMAL ASSESSMENT AND MONITORING PROGRAM

Data Base Management Activities Progressing Well

Data base management activities in the Marine Mammal Program at La Jolla have been progressing well during July. Charles Oliver, Computer Specialist, who heads this subtask, reports that the backlog of 1977 marine mammal sightings and sighting effort data from NMFS observers aboard tuna vessels has been eliminated and the data resides presently on computer accessible data bases. Processing of 1978 new data now runs currently with receipt of the data. New formats have been created in 1978 for the life history information recorded on marine mammals. The new format is more efficient and includes new informational items.

Life history data from previous years have been converted to this new format. Philip Tarantino, working on a student appointment, has reviewed the historical data base management programs and procedures. He has also updated and documented the procedures for easy referral.

MARINE MAMMAL BIOLOGY AND TECHNOLOGY PROGRAM

NMFS Scientists to Test Theory That Porpoise Schools Have Learned to Avoid Tuna Boats

At sea in waters south and west of the Galapagos Island is the three-masted barkentine, the Regina Maris. Aboard are Dr. Warren Stuntz, an animal behaviorist at the La Jolla Laboratory and Thomas Shay, Biological Technician, who left San Diego on July 30 to join the ship in Panama. The objective of their proposed 30-day voyage on the sailing vessel is to study porpoise schools to determine their reactions to small, unmotorized vessels. Stuntz and others have theorized that an apparent decline in the number of porpoise schools being sighted may be the result of the animals having been repeatedly set upon tuna purse seiners and that they now have presumably learned to identify and avoid approaching such vessels. Since the porpoise schools in the Galapagos have not been subject to purse seine operations they cannot have learned such behavior.

Radio Transmitters for Tracking Porpoise Schools Tested

A preliminary range test was conducted on July 13 of the VHF radio transmitters which will be used during Cruise IV of the dedicated vessel program. All equipment, according to Jackie Jennings, functioned satisfactorily over a distance of about 4 miles. Additional range tests will be conducted on the VHF as well as on the CB transmitters to test their transmission over approximately 10 miles. Both sets of transmitters have been hydrostatically tested by Scripps Institution of Oceanography to 1000 feet.

The CB and VHF transmitters will be used on the Queen Mary to track porpoise schools for up to 6 days for study of school dynamics.

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Dr. Howard Baldwin, Sensory Systems, Inc., Alberta, Canada, discussed possible uses of his microwave telemetry system with Jackie Jennings at the Center on July 24. His transmitters are approximately 1" square and are solar powered. Jennings reports that some problems with the system have been identified, such as fouling of the solar windows but she finds the system to be potentially useful for long term tracking of porpoise.

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Other developments in the Marine Mammal Biology and Technology Program included the following:

Wildlife Biologist A. Myrick, who is assisting the Program Leader, Dr. W. Perrin, in planning for the International Conference on Determining Age of Odontocete Cetaceans scheduled to be held at Scripps Institution of Oceanography in La Jolla, September 5-7, reports that at least 150 attendees are expected, of whom about 70 will be giving talks.

Myrick also reports that during July about 30 biological technicians from the NMFS Southwest Region Field Office in San Diego were given training at the Southwest Fisheries Center in techniques for dissecting porpoise, identification of marine mammals, and instructed in how to complete porpoise observer forms. As part of their training, a lecture was presented by James Coe, Head of the Mortality Reduction Technology group, to the technicians who will be going to sea to collect data on the porpoise/tuna interaction on the evolution of the super-apron (an extension or lip of the purse seine which enables animals to be more easily removed from the net).

Three contracts for a mathematical model of net dynamics, engineering specifications for net scaling and development of attachable purse seine floats that do not require cutting the purse seine have gone forward to NASO in Seattle for implementation.

Behavioral Studies of Porpoise Planned on Dedicated Vessel Cruise

The tuna seiner, Queen Mary, has been dedicated to research on the porpoise/tuna interaction by the U.S. industry for one year. Cruise III, Leg II on the Queen Mary left San Diego on July 20. Activities during this leg will concentrate on behavioral studies and tuna olfaction studies. A contract for the behavioral studies has been awarded to Karen Pryor, a freelance consultant and Ingrid Kang of Sea Life Park in Hawaii, and the tuna olfaction studies are being conducted by Walter Ikehara and Andy Britton of University of Hawaii. Dave Bratten, Biological Technician at the La Jolla Laboratory is serving as Chief Scientist on this cruise. The sixth scientist aboard is Phillippe Vergne of LMR, Inc. who will be assisting in all aspects of the planned research.

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Contract Awarded for Development of Experimental Design for Mark-Recapture Studies

Dr. Morris Southward and Dr. N. Scott Urquhart of New Mexico's State University's Department of Experimental Statistics met with the staff of the Marine Mammal Program, July 5-7, to discuss the contract awarded them to develop an experimental design for mark-recapture studies of the eastern tropical Pacific porpoise stocks. Southward and Urquhart

are providing statistical designs for future tagging studies on marine mammals. The contract work will provide several choices of experimental design depending upon the confines of acceptable bias, variability, species of import, and future budget levels. Because of these restrictions the end-product of the studies remains to be determined. However, optimally the tagging studies will provide estimates in selected areas for calibration with other methods of measuring abundance, estimates of school size, migration patterns, and age and sex distributions within the populations. The statistical designs are scheduled for completion in September 1978.

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Possibilities for Joint Marine Mammal Research With Mexico Explored

Drs. William Fox, William Perrin, and Joseph Powers traveled to the Northwest and Alaska Fisheries Center in Seattle July 24-25, to discuss possibilities for joint marine mammal research with Mexico. Dr. George Harry, Director of the Marine Mammal Division of the Northwest and Alaska Fisheries Center chaired the meeting. Mexico was represented by Jorge Carranza of the Instituto Nacional de Pesco and Dr. Bernardo Villa of UNAM Cuidad Universitaria. Cooperative research on Mexican marine mammals was discussed and priorities, both that of U.S. and Mexican, were delineated. A report of the conclusions of this meeting is forthcoming.

TIBURON LABORATORY

FISH COMMUNITIES INVESTIGATION

Symposia Consider Problems in Fisheries Management

Predator-prey systems in fish communities, and their role in fisheries management, were the subject of a symposium this month at Atlanta, Georgia, sponsored by the Sport Fishing Institute. Dr. Edmund Hobson, Investigation Leader, presented a paper entitled, "Relationships among piscivorous fishes and their prey," which along with the other presentations, will be published as a book.

The 1977 Rockfish Survey, which considered the status of these valuable resources in the Pacific Northwest, was the subject this month of a sumposium, sponsored by NMFS, in Seattle. Dr. William Lenarz, Leader of the Rockfish Analysis Task, along with Fishery Biologists Peter Adams and Tina Echeverria, presented papers. Certain of the presentations at this symposium, including those of Adams and Lenarz, will

be submitted for publication in Marine Fisheries Review as a collection, edited by Lenarz and Dr. D. Gunderson, of the Northwest and Alaska Fisheries Center, Seattle.

Manuscript Completed on Design of Trawl Surveys for Rockfish

"Some statistical considerations in designing trawl surveys for rockfish (genus Sebastes)" is the title of a paper completed this month by Lenarz and Adams. When the illustrations are in final form, and after the initial reviews, the paper will be submitted to the Fishery Bulletin.

Analysis Shows Patterns in the Distributions of Fishes Among Nearshore Habitats

Although the more common nearshore fishes in southern California tend to occur widely through the different nearshore habitats, they tend to be more abundant in one, or sometimes two, of these habitats. This is the conclusion of Peter Adams after analyzing data from the transect counts made by Hobson and Tony Chess. The species tend to be aggregated, but not to the degree of more pelagic species. Some species, for example, the black seaperch (Embiotoca jacksoni), have low densities but more regular (less aggregated) distributions. Following another common pattern, in certain species the adults tend to be far less aggregated than the juveniles. For example, adult kelp bass, Paralabrax clathratus, have a variance/mean ratio that ranges from 1.5 to 3.5 (a variance/mean ratio of 1.0 indicates a random distribution) while the juveniles have ratios as high as 102.

Juvenile Rockfishes Found Less Numerous This Year

The numbers of juvenile rockfish that have settled in the nearshore habitats on the Mendocino coast remain far below their numbers at this time last year. This is the finding of Hobson and Chess at their study site at Albion. Although last year was an unusually rich year class for many species, it may be of particular significance that juveniles of the bocaccio, Sebastes paucispinis, which were among the more numerous last year, have not been seen at all this year.

FISH DEVELOPMENT INVESTIGATION

Return Rate of King Salmon Encouraging

Nineteen more tags from the 1976 release of king salmon were returned by anglers this month. The return rate of these fish is currently estimated at 15.8%--over four times as great as that of any previous releases of coho salmon.

The coho salmon, raised for the Tiburon Laboratory at Rochester, Washington, died during transit to Tiburon Laboratory. An investigation of the causes of this loss is continuing.

The salt-water disease, Vibrio anguilarium, appeared in one pen, containing 50,000 king salmon. The disease was checked, after a 10% loss, with Terramycin treatment administered in the food.

Weight samples of the king salmon being reared indicated a doubling of fish size in four weeks, which is a good rate of growth. Earlier indications of malnutrition were treated by additions of extra vitamin supplements to the food.

Because of the loss of the coho salmon, it is planned to rear the king salmon for a longer period, into October, and mark several thousand with Carlin tags. Half of these fish are already marked with wire nose tags.

Changes in Angling Techniques

The manuscript "Changes in salt water angling equipment and methods in California," by S. Smith was returned by two reviewers connected with the recreational fishing industry. Smith reports that the paper will probably be expanded to include changes in the offshore rockfish sport fishery, and the term "sport-fishing boat" substituted for "partyboat." In recent years the recreational fishing industry has increased its efforts to discourage the term "partyboat" because in their veiw it connotes an inappropriate image of the industry. The State of California now recognizes sport boats as commercial passenger fishing vessels (CPFV's) for tax and other purposes, and it is hoped that research and management people will adopt either this term or the equally acceptable alternate, sport-fishing boat or vessel.

First Draft of Groundfish Management Plan Completed

Ed Ueber, Economist at the Tiburon Laboratory, who is a member of both Groundfish and Dungeness Crab Management Plan Development Teams, as well as the Pacific Fishery Management Council's ad hoc economic committee, reported that the first draft of the Groundfish plan has been completed for presentation to the Council in August.

PHYSIOLOGY INVESTIGATIONS

Striped Bass Larvae Demonstrate Ability to Withstand Starvation

Dr. J. Whipple, Leader of the Striped Bass Task, reports that in three years of laboratory experiments, striped bass larvae have demonstrated the ability to withstand starvation for periods up to 34 days after fertilization. In an effort to determine the time when larvae die

regardless of the presence of food (commonly called the point-of-no-return), the introduction of food was delayed in 4-day intervals from days 10 to 26. The striped bass larvae which has survived to the different introduction times were able to initiate feeding successfully.

Larvae deprived of food up to 22 days survived at almost the same rates as those fed from day 7 when feeding normally begins.

Growth to the end of the experiment, 31 days after fertilization, was inversely related to the time of food introduction. As larvae began to feed they assumed growth rates identical to those which had begun on day 7. The following table displays the different sizes of larvae at the end of the experiment.

Day of Food Introduction	10	14	18	22	26
Standard Length (mm)	11.4	10.4	9.0	7.4	6.1
Tissue Dry Weight (mg)	5.83	3.43	1.54	.36	.14

The point after which other larval fish species have been unable to begin feeding varies considerably from a few to 36 days. Almost all demonstrated a critical period. The only other fish reported which is as resistant to food deprivation as the striped bass was the grunion, Leuresthes tenuis.

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CalCOFI Data Management System Implemented

Fred Kellenberger, Data Systems Manager for the Southwest Fisheries Center, reports that the CalCOFI data management system was successfully implemented in mid-June. The required anchovy biomass report was submitted to the anchovy management group prior to the deadline data. In order to meet the target date, the design and programming were frozen. During the data processing cycle of the biomass estimate, program inefficiencies were noted for resolution at a later date. The ADP group at La Jolla, along with the CalCOFI data manager, Rich Charter, reviewed the problems that occurred during the implementation of the CalCOFI system. Based on this review, the program series for the first phase of the data base system were refined. User's and programmer's documentation are being finalized.

Pacific Area Cooperative Enforcement System (PACES) Design Completed

The Pacific Area Cooperative Enforcement System (PACES) is a joint enforcement system with NMFS and the California Department of Fish and Game (CF&G). A law enforcement project workshop was held in Long Beach

on June 6 and 7, 1978. Representatives from the SWFC, SWR and CF&G participated in the workshop. Kellenberger attended as the representative of the Center. The inputs and outputs of PACES were defined during the workshop. The boarding patrol, sighting and offense investigation report forms to be used in conjunction with the computerized system were adopted at the workshop. California Fish & Game commercial fishing licenses, vessel registration and permit information will be included in PACES. The system design and the data base design was completed in July. Programming has started and PACES is scheduled to be implemented in October 1978.

Market News Data Base Management System
Under Development for Southwest Region

A computerized market news system is being developed for the SWR. The system will allow SWR personnel to enter data and extract information on a timely basis. SWR personnel will use the system on a real time basis. Three years of market news of Continental Tuna Data have been keypunched for the insertion into the Market News Data Base. All appropriate software for producting Continental Cannery Tuna Receipt report has been written and is presently being tested.

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The Financial Reporting System (FRS) is an internal bookkeeping system that provides financial information to the project managers, planning officers, financial officers, division chiefs, and laboratory directors. Kellenberger reports two significant developments in the FRS. First, a new report, the Center-wide Resource Review, was programmed and added to the system. This program shows expenditures by Object Class by appropriation. Second, the FRS was implemented at the Southwest Region office at Terminal Island. The SWR data is coded and is up to date on the system. Other centers and regions have expressed an interest in utilizing the FRS. A meeting will be held on September 11-13, 1978 in Washington, D.C., where attendees from the various centers and regions will discuss utilizing the FRS.

HONORS AND AWARDS

Mr. Tamio Otsu, Fishery Biologist, was presented a Superior Performance Award on July 10.

Dr. Gary Sakagawa, Fishery Biologist, La Jolla - Cash Award.

James Squire, Fishery Biologist at the La Jolla Laboratory, and Susan Smith, Fishery Biologist at the Tiburon Laboratory, - Cash Awards for their joint authorship of the Angler's Guide.

Dr. Edmund Hobson, Leader of the Fish Communities Investigation at the Tiburon Laboratory, has been reappointed as a Research Associate of the Scripps Institution of Oceanography.

PUBLIC AFFAIRS

July 12 - A Scripps Institution of Oceanography summer school class in oceanography and marine biology with their instructor Parker Olson visited the Center to view the new slide show of research activities here and for a tour of the facilities. L. Vlymen was the lecturer and tour guide.

20 - Students from the Youth Employment and Training Program (YETP) of the San Diego City Schools, accompanied by Freyda M. Cohen, Career Counselor, YETP, visited the Center to view the slide show and tour the laboratory. L. Vlymen was the tour guide.

TRAINING

July 19-20 - Maureen Woods, Librarian at Tiburon, and Susan Covey, Librarian at La Jolla, SDC Search Service New User Training Workshop. Systems Development Corp., Santa Monica, California.

July 31 - August 2 - Eugene Burke (Tiburon) CSC, Pre-Retirement Counseling.

July - Susumu Kato (Tiburon) CSC, NIS-Applied Supervision.

SEMINARS

La Jolla Laboratory

July 10 - Dr. Daniel Goodman, SIO, spoke on "Population dynamics and the maximum yield problem," as part of the regularly scheduled seminar series at the Center.

24 - Dr. Allen Mearns, Southern California Coastal Water Research Project discussed, "Problems in assessing effects of pollution on nearshore fish populations."

MEETINGS AND TRAVEL

June 28 - July 3 - Dr. A. Alvariño, Fishery Biologist, was in Washington, D.C. to prepare final data on plankton research and the U.S. Antarctic Research program.

July 3-7 - MacCall attended ICES Symposium on the Biological Basis of Pelagic Fish Stock Management held in Aberdeen, Scotland.

5-7 - Dr. G. Moser, Leader of the Multispecies Taxonomy group at La Jolla, traveled to Seattle, Washington to attend a Rockfish Survey Coordinating Meeting as a member of the Steering Committee.

6 - J. Carr, Deputy Director, and D. Mackett, Planning Officer, traveled to Terminal Island to meet with F. Anders, Deputy Regional Director, and J. Gettleman, Regional Planning Officer.

- R. Shomura, Laboratory Director at Honolulu, attended a meeting called by Wadsworth Yee, Grand Pacific Life Insurance Company, to discuss the possibility of constructing a flash-freezer plant in Honolulu.

6-7 - Dr. William Lenarz, Peter Adams and Tina Echeverria, Tiburon Laboratory, traveled to NWAFC, Seattle, to attend a rockfish survey meeting where all presented papers.

7 - D. Huppert and G. Stauffer, La Jolla Laboratory, attended the Meeting of Anchovy Advisory Panel at Long Beach.

9-12 - Dr. W. Fox, Leader of the Oceanic Fisheries Resources Division, was in Long Beach to attend a meeting on development of U.S. positions on tuna allocation in the eastern tropical Pacific.

9-14 - Dr. R. Lasker, Leader of the Coastal Fisheries Resources Division, was in Estes Park, Colorado to participate in a NOAA Workshop on Marine Pollution Monitoring and Research Needs.

10-12 - Ed Ueber, Tiburon Laboratory, attended a meeting of the Dungeness Crab Management Plan Development Team at Eureka.

10-16 - Representing the Center E. Sandknop, Biological Technician, traveled to Denver, Colorado to attend the National Federally Employed Women's (FEW) Conference.

July 11-14 - Shomura traveled to California where he met with Department of State staff at SWFC, La Jolla on July 13 to review the status of the organization of the South Pacific Fishery Agency and with Center officials on July 14.

12-13 - Director Barrett in Monterey, California to attend the meeting of the Pacific Council's Scientific and Statistical Committee meeting. Also in Monterey were Drs. D. Huppert and G. Stauffer who attended the Pacific Fishery Management Council meeting.

12-14 - Lenarz and Ueber attended the Scientific & Statistical meeting of the Pacific Fishery Management Council at Monterey.

12-15 - J. Coe, Fishery Biologist was in Little Rock, Arkansas to consult with contractors who are building the support boat for the Porpoise Impoundment System. Later, Coe traveled to Bay St. Louis, Mississippi to discuss engineering requirements for intended modification to the system.

20 - Huppert and McMillan participated in meeting of Western Association of Fish and Wildlife Agencies and Western Div., American Fisheries Society in San Diego.

21 - Huppert traveled to San Francisco to meet with Wes Silverthorne and Ed Ueber, Economists at Terminal Island and Tiburon, respectively.

- Ueber attended an ad hoc committee meeting of the Pacific Fishery Management Council on fisheries economic research for Washington, Oregon and California at Burlingame.

- Shomura attended the Pacific Tuna Development Foundation Board of Directors Meeting at the Sheraton-Waikiki Hotel.

23-25 - Drs. W. Fox, J. Powers and W. Perrin, La Jolla, in Seattle to participate in planning for joint marine mammal research with the Northwest and Alaska Fisheries Center and Mexican scientists. Several proposals were presented by U.S. scientists involving coastal marine mammals, pinniped research, whale studies, and studies of eastern tropical Pacific dolphins.

24-25 - Lenarz and Ueber, Tiburon Laboratory, traveled to Seattle to attend a meeting of the Groundfish Management Plan Development Team.

24-27 - Dr. E. Hobson to Atlanta, Georgia to attend the Predator-Prey Symposium sponsored by the Sport Fishing Institute and presented a paper.

July 25 - Roger Green, Tiburon Laboratory, attended a meeting of the Tyee Club in San Francisco and presented a talk summarizing the cooperative salmon pen-rearing project.

July 25 - August 4 - Eric Barham, Fishery Biologist at La Jolla, traveled to Pacific Grove, California to extract marine mammal sighting data from Hopkins Marine Station Ocenaographic cruise records.

25-29 - Administrative Assistant B. Engstrand, La Jolla, was the the Center's delegate to attend the NMFS National EEO Committee Workshop in Washington, D.C.

27 - MacCall and Stauffer met with Nelson Erhardt (FAO/INP, Mexico City) to exchange views and discuss future research plans in Mexico.

28 - Data Systems Manager F. Kellenberger traveled to Terminal Island to attend a meeting with CF&G and Southwest Region staff on data management activities.

30-31 - F. Kellenberger, La Jolla, traveled to Seattle, Washington to attend the Pacific Fishery Management Council meeting.

31 - Shomura met with Messrs. R. Schoning, W. Yee and W. Van Campen to discuss Western Pacific Council matters in general. Mr. Schoning also met in the afternoon with several Honolulu Laboratory staff members to discuss Council-NMFS relations.

July 31 - August 3 - Director Barrett was in Washington, D.C. to attend the Regional/Center Directors' meeting.

VISITORS

Honolulu Laboratory

July 6 - Joseph E. King, former Honolulu Laboratory and BCF-Washington employee, now retired and living in St. Simons Island, Georgia.

7 - Clifford H. Fiscus, NMFS Seattle, and Karl W. Kenyon, who is serving as a member of the Marine Mammal Commission's Committee of Scientific Advisors on Marine Mammals, visited Director Shomura.

13 - Dr. Sigeru Motoda, Tokai University, Shimizu, Japan.

July 17 - Charlotte Maulden, Pago Pago, American Samoa

18 - Dr. Thomas Rohlen, visiting Professor of Anthropology at the University of Hawaii from the University of California Santa Cruz, visited T. Otsu. Rohlen was interested in organizational structures within the Japanese fishing industry. He provided Otsu with several of his papers dealing with work he had done in Japan.

20 - David Mackett, SWFC, La Jolla visited and conducted a Tuna Planning Meeting.

25 - Ltjg. Howard A. Jemison III, NOAA Corps Officer who will be assigned to the Honolulu Laboratory in the near future, visited Shomura.

26 - Dr. Yasuhiko Shimadzu, a visiting scholar (supported by the Japanese government) at the Center for Quantitative Science in Forestry, Fisheries, and Wildlife, University of Washington, Seattle, Washington, stopped over in Honolulu en route to Japan and met Shomura and Otsu; he also met with Drs. Wetherall and Skillman to discuss population biology and dynamics. In recent years Shimadzu has been working on population dynamics of demersal fishes in the Eastern China Sea and the Yellow Sea.

La Jolla Laboratory

July 5 - Dr. Kurt Kline, Cal Poly State University, San Luis Obispo.

7 - Leo Pinkas, Marine Biologist, California Department of Fish and Game, Long Beach, California.

13 - The following participants at the NMFS Planning Conference III held in San Diego visited the Southwest Fisheries Center after the close of their meetings: From the Northeast Region--Jon Rittgers and Carl D'Epiro; from the Northeast Center--George Ridgway, Mary Laird, and Herb Stern and from the Central Office in Washington, D.C.--Fred Brooks, Einar Wold and Jerry Hogg. Center Director Barrett addressed the group on the opening day of the Conference. David Mackett, Center Planning Officer, also attended the Conference and hosted the group during their visit to the Center.

18 - Walter Ikehara, University of Hawaii, Hawaii Institute of Marine Biology, Honolulu.

July 19 - Dr. Bangalore Sundararaj, Fishery Biologist, University of Delhi, India. As part of Dr. Sundararaj's visit, Dr. Reuben Lasker arranged a round-table discussion in the auditorium on endocrinology and gonad maturation in fishes.

20 - Dr. Merritt Tuttle, NMFS, Portland, Oregon.

- Roy J. Wahle, NMFS, Portand, Oregon.

27 - Julie Moore, Biological Information Service, Riverside, California.

Pacific Environmental Group

July 12 - Izadore Barrett, SWFC, La Jolla, California.

28 - Ldcr. Craig Nelson, NOAA/NMFS, Honolulu, California.

Tiburon Laboratory

July 3 - T. Roger Haas, Silver King Oceanic Farms, San Ardo, California.

12 - W.T. Davoren, U.S. Fish & Wildlife Service, San Francisco, California.

- Jay F. Watson, U.S. Fish & Wildlife Service, Portland, Oregon.

- Paul H. Meiling, U.S. Fish & Wildlife Service, Meridian, Idaho.

13 - Charlotte Green, CETA, San Rafael, Calfiornia.

- Sunee Sonu, NMFS, Southwest Region, Terminal Island, California.

- K. Takayama, Wescon, San Francisco, California.

- Florence McIntyre, Tiburon, California.

17 - Msgr. Felipe Diaz, Philippine Mission, Pampanga, Philippines.

- James A. Coyer, Catalina Marine Science Center, Avalon, California.

18 - Ron Eggers, Bechtel Environ. Services, San Francisco, California.

July 25 - D. D. Bischop, Fisherman, Fort Bragg, California.

28 - Alan Thompson, Regional Water Quality Control Board, Oakland, California.

- Teresa Quan, Regional Water Quality Control Board, Oakland, California.

PERSONNEL

July 11 - Valerie Spowart, Cash and Attendance Clerk, Temporary Appointment - La Jolla Laboratory.

16 - Susan Smith, Reclassification from Publications Specialist to Fishery Biologist - Tibruon Laboratory.

- Debra P.L. Chow, Computer Programmer, Part-time Intermittent appointment - Honolulu Laboratory.

22 - Cindy Muncy, Cash and Attendance Clerk, Resignation - La Jolla Laboratory.

27 - Charles Oliver, Computer Specialist, Promotion - La Jolla Laboratory.

- Frank Ralston, Biological Technician, Promotion - La Jolla Laboratory.

30 - Jose Enitan, Biological Aid (Microbiology), Resignation - Honolulu Laboratory.

- Tim Smith, Fishery Biologist, Change in Duty Station - La Jolla Laboratory.

31 - Karen Pasciuti, Lt. NOAA Corps, Resignation - Tiburon Laboratory.

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